CLAIMS

What is claimed is:

1. A data storage element, comprising:

a substrate comprising a semiconductor material;

a metal oxide layer comprising an electrically insulating rare earth metal oxide disposed upon a surface of said substrate;

a conductive material disposed upon said metal oxide layer;

a first electrode electrically connected to said conductive material; and

a second electrode connected to said substrate.

2. The data storage element as set forth in Claim 1, wherein said metal oxide comprises lanthanum oxide.

3. The data storage element as set forth in Claim 1, wherein said metal oxide comprises a mixture of lanthanum oxide and aluminum oxide.

4. The data storage element as set forth in Claim 3, wherein said conductive material comprises metallic aluminum.

5. The data storage element as set forth in Claim 1, wherein said metal oxide comprises at least one of:

1) lanthanum oxide, and

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2) a mixture of lanthanum oxide and aluminum oxide, and said conductive material comprising metallic aluminum.

6. The data storage element as set forth in Claim 1, wherein said metal oxide layer has a thickness of 10-10,000 Angstroms.

7. The data storage element as set forth in Claim 6, wherein said metal oxide layer has a thickness of 50-500 Angstroms.

8. The data storage element according to claim 1, wherein said conductive material comprises polysilicon.

9. The data storage element according to claim 1, wherein said conductive material comprises Aluminum.

10. A data storage element, comprising:

a substrate comprising a semiconductor material having a source region and a drain region formed in a surface of said substrate;

a layer of metal oxide disposed upon said surface of said substrate and between said source region and said drain region, said metal oxide comprising at least one metal which has a plurality of oxidation states;

a conductive layer disposed upon said layer of metal oxide;

a first electrode electrically connected to said conductive layer;

a second electrode connected to said source region; and

a third electrode connected to said drain region.

11. A data storage element as set forth in Claim 10, said semiconductor material being n-doped silicon, said metal oxide comprising at least one of lanthanum oxide and a mixture of lanthanum oxide and aluminum oxide, and said conductive layer comprising metallic aluminum.

12. The data storage element as set forth in Claim 10, wherein said semiconductor material comprises n-doped silicon.

13. The data storage element as set forth in Claim 10, wherein said metal oxide comprises at least one of lanthanum oxide, and a mixture of lanthanum oxide and aluminum oxide.

14. The data storage element as set forth in Claim 10, wherein said conductive layer comprises metallic aluminum.

15. A method of forming a data storage element, said method comprising:

forming a metal oxide layer on a substrate, said metal oxide layer comprising an electrically insulating rare earth metal oxide disposed upon a surface of said substrate;

disposing a conductive material upon said metal oxide layer;

electrically connecting a first electrode to said conductive material; and

connecting a second electrode to said substrate.

16. The method of claim 15, wherein said metal oxide comprises lanthanum oxide.

17. The method of claim 15, wherein said metal oxide comprises a mixture of lanthanum oxide and aluminum oxide.

18. The method of claim 17, wherein said conductive material comprises metallic aluminum.

19. The method of claim 15, wherein said metal oxide comprises at least one of:

1) lanthanum oxide, and

2) a mixture of lanthanum oxide and aluminum oxide, and said conductive material comprising metallic aluminum.

20. The method of claim 15, wherein said metal oxide layer has a thickness of 10-10,000 Angstroms.

21. The method of claim 20, wherein said metal oxide layer has a thickness of 50-500 Angstroms.

22. The method of claim 15, wherein said conductive material comprises polysilicon.

23. The method of claim 15, wherein said conductive material comprises Aluminum.

24. A memory, comprising:

a rare-earth based memory element using hysteresis and current-voltage characteristics thereof to store data.

25. The memory as set forth in Claim 24, wherein said memory element comprises:

a substrate;

a metal oxide layer comprising an electrically insulating rare earth metal oxide disposed upon a surface of said substrate; and

a conductive material disposed upon said metal oxide layer.

26. The memory as set forth in Claim 25, wherein said metal oxide comprises lanthanum oxide.

27. The memory as set forth in Claim 25, wherein said metal oxide comprises a mixture of lanthanum oxide and aluminum oxide.

28. The memory as set forth in Claim 27, wherein said conductive material comprises metallic aluminum.

29. The memory as set forth in Claim 25, wherein said metal oxide comprises at least one of:

1) lanthanum oxide, and

2) a mixture of lanthanum oxide and aluminum oxide, and said conductive material comprising metallic aluminum.

30. The memory as set forth in Claim 25, wherein said substrate comprises n-doped silicon, said metal oxide comprising at least one of lanthanum oxide and a mixture of lanthanum oxide and aluminum oxide, and said conductive material comprising metallic aluminum.